

What is claimed is:

1. An optical pickup apparatus comprising:

first, second and third light sources emitting light fluxes having wavelengths of λ_1 , λ_2 ($\lambda_1 < \lambda_2$) and λ_3 ($\lambda_2 < \lambda_3$) respectively;

a light converging optical system including an objective optical element, converging a light flux emitted from the first light source onto a first information recording surface on a first optical information recording medium through a first protective layer with a thickness of t_1 so as to conduct recording or reproducing information for the first optical information recording medium, converging a light flux emitted from the second light source on a second information recording surface on a second optical information recording medium through a second protective layer with a thickness of t_2 so as to conduct recording or reproducing information for the second optical information recording medium, and converging a light flux emitted from the third light source on a third information recording surface on a third optical information recording medium through a third protective layer with a thickness of t_3 ($t_1 < t_3$ and $t_2 < t_3$) so as to conduct recording or reproducing

information for the third optical information recording medium,

wherein the light converging optical system introduces the light flux emitted from the first light source as an infinite parallel light flux to be incident on the objective optical element when information is reproduced from or recorded on the first information recording medium; and

wherein the light converging optical system includes:

a spherical aberration correcting structure to correct a spherical aberration caused by at least one of a difference in thickness among the first to third protective layers and a difference in wavelength among light fluxes from the first to third light sources; and

a chromatic aberration correcting element arranged in an optical path where a light flux emitted from the first light source passes and suppressing a variation of a chromatic aberration based on a wavelength variation in a light flux emitted from the first light source.

2. The optical pickup apparatus of claim 1, wherein the thickness of t_1 and t_2 satisfy a following relationship:

$$0.9 \cdot t_1 < t_2 < 1.1 \cdot t_1$$

3. The optical pickup apparatus of claim 1, comprising a spherical aberration correcting element having the spherical aberration correcting structure in a common path where all of the light fluxes emitted from the first to third light sources pass.

4. The optical pickup of claim 2, comprising a spherical aberration correcting element having the spherical aberration correcting structure.

5. The optical pickup apparatus of claim 1, wherein the objective optical element has the spherical aberration correcting structure.

6. The optical pickup apparatus of claim 1, wherein the second and third light sources are attached on the same base board.

7. The optical pickup apparatus of claim 4, wherein the second and third light sources are attached on the same base board.

8. The optical pickup apparatus of claim 1, wherein the light converging optical system introduces the light flux emitted from the third light source as a finite divergent light flux to be incident on the objective optical element when information is reproduced from or recorded on the third information recording medium.

9. The optical pickup apparatus of claim 7, wherein the light converging optical system introduces the light flux emitted from the third light source as a finite divergent light flux to be incident on the objective optical element when information is reproduced from or recorded on the third information recording medium.

10. The optical pickup apparatus of claim 1, wherein the light converging optical system introduces the light flux emitted from the second light source as a finite divergent light flux to be incident on the objective optical element when information is reproduced from or recorded on the second information recording medium.

11. The optical pickup apparatus of claim 9, wherein the light converging optical system introduces the light flux

emitted from the second light source as a finite divergent light flux to be incident on the objective optical element when information is reproduced from or recorded on the second information recording medium.

12. The optical pickup apparatus of claim 11 wherein the finite divergent light flux which is incident into the objective optical element in case that information is reproduced from or recorded on the second information recording medium has a smaller divergent angle than the finite divergent light flux which is incident into the objective optical element in case information is reproduced from or recorded on the third information recording medium.

13. The optical pickup apparatus of claim 1, wherein the light converging optical system comprises a collimator, and light fluxes emitted from the first to third light sources pass through the collimator toward the objective optical element.

14. The optical pickup apparatus of claim 1, wherein the first to third light sources are arranged with the same distance from the objective optical element.

15. The optical pickup apparatus of claim 1, wherein the chromatic aberration correcting element is at least one of a beam expander, a collimator and a coupling lens.

16. The optical pickup apparatus of claim 15, wherein the chromatic aberration correcting element is a beam expander.

17. The optical pickup apparatus of claim 11, wherein the chromatic aberration correcting element is at least one of a beam expander, a collimator and a coupling lens.

18. The optical pickup apparatus of claim 17, wherein the chromatic aberration correcting element is a beam expander.

19. The optical pickup apparatus of claim 3, wherein at least a part of the spherical aberration correcting element is movable along an optical axis.

20. The optical pickup apparatus of claim 3 wherein the spherical aberration correcting element is at least one of a beam expander, a collimator and a coupling lens.

21. The optical pickup apparatus of claim 18, wherein the spherical aberration correcting element is at least one of a beam expander, a collimator and a coupling lens.

22. The optical pickup apparatus of claim 20, wherein the spherical aberration correcting element is a beam expander.

23. The optical pickup apparatus of claim 21, wherein the spherical aberration correcting element is a beam expander.

24. The optical pickup apparatus of claim 3, wherein the spherical aberration correcting element is a liquid crystal element.

25. The optical pickup apparatus of claim 3, wherein the spherical aberration correcting element corrects a spherical aberration caused by temperature variation in the objective optical element.

26. The optical pickup apparatus of claim 1, wherein the objective optical element is made of a plastic material.

27. The optical pickup apparatus of claim 23, wherein the objective optical element is made of a plastic material.

28. The optical pickup apparatus of claim 26, wherein an incidence plane of a light flux emitted from the light sources in the objective optical element is a refracting surface.

29. The optical pickup apparatus of claim 27, wherein an incidence plane of a light flux emitted from the light sources in the objective optical element is a refracting surface.

30. The optical pickup apparatus of claim 1, wherein the objective optical element is made of a glass material.

31. The optical pickup apparatus of claim 1, further comprising an aperture limiting element.